

Chronic Pain and Psychological Distress Among Undocumented Latinx Immigrants in the USA



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BACKGROUND: Undocumented immigration is often accompanied by multiple and complex stressors, which over time may increase the risk for chronic pain.

OBJECTIVE: This study aimed to identify the prevalence of chronic pain and its association with psychological distress among undocumented Latinx immigrants in the USA.

DESIGN/PARTICIPANTS: We used respondent-driven sampling to collect and analyze data from clinical interviews with 254 undocumented Latinx immigrants, enabling inference to a population of 22,000.

MAIN MEASURES: Chronic pain was assessed using the World Health Organization Composite International Diagnostic Interview (CIDI) Chronic Conditions Module. For all analyses, inferential statistics accounted for design effects and sample weights to produce weighted estimates. We conducted logistic regression analyses to assess the association between chronic pain and psychological distress after controlling for age, years in the USA, and history of trauma.

RESULTS: A total of 28% of undocumented Latinx immigrants reported having chronic pain, and 20% of those had clinically significant psychological distress. Significant differences in the prevalence of chronic pain were reported across age groups, years in the USA, and trauma history. After controlling for relevant covariates, chronic pain was significantly associated with psychological distress (OR = 1.06, 95% CI [1.02, 1.09]), age (OR = 1.05, 95% CI [1.02; 1.09]), and history of trauma (OR = 1.10 per additional traumatic event, 95% CI [1.02; 1.19]; C-statistic = 0.79).

Highlights

- This study is the first to document the prevalence of chronic pain among undocumented Latino immigrants in the USA and emphasizes the magnitude of chronic pain as a health concern for this at-risk immigrant population.
- Among undocumented Latino immigrants, chronic pain is common and significantly associated with psychological distress, as well as age and history of traumatic events.
- These findings highlight the need for prevention efforts and access to context- and culturally sensitive interventions for undocumented immigrants to prevent the detrimental health, economic, and social consequences associated with chronic pain.

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CONCLUSION: Among undocumented Latinx immigrants, chronic pain is significantly associated with psychological distress, older age, and trauma history. Given that undocumented immigrants have restricted access to healthcare and are at high risk for chronic pain, developing alternatives to facilitate access to chronic pain interventions and risk-reduction prevention are needed.

KEY WORDS: chronic pain; distress; mental health; undocumented immigrants; Latinx.

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Chronic pain is a global health concern associated with detrimental pathophysiological, functional, economic, and social consequences.¹ Chronic pain is generally defined as continuous or intermittent pain or discomfort that persists for at least 3 months.² Approximately 1.5 billion people live with chronic pain worldwide, with US national estimates exceeding 100 million.³ Furthermore, in the USA, racial/ethnic disparities exist with regards to experiencing chronic pain.¹ For instance, Latinxs tend to report a lower prevalence of chronic pain and less pain interference with daily functioning when compared with non-Latinx whites, but *greater* pain severity.⁴ Likewise, disparities between these groups exist in accessing, seeking, and responding to treatment for pain.⁴ Nonetheless, less is known about the prevalence of pain and the pain experience among Latinxs who are hidden or hard-to-reach, such as undocumented immigrants.

The undocumented immigration path is often accompanied by multiple and complex stressors, which over time may increase the risk for chronic pain. Hazardous working conditions, limited healthcare access, exploitation, and stigmatization are factors that could make undocumented immigrants vulnerable to chronic pain. For instance, undocumented immigrants are more likely than their documented counterparts to undertake physically demanding jobs in industries with high

rates of injuries and exposure to hazardous conditions.^{5–7} Non-job-related trauma is another cause of pain in immigrants^{8,9}—approximately 83% of undocumented immigrants report a lifetime history of trauma.¹⁰ Compounding these problems, limited healthcare access and lack of insurance force immigrants to pay out of pocket for healthcare; turn to unsafe or non-evidence-based healing practices (e.g., herbal remedies, *hueseros*, or bone/muscle therapy); or neglect healthcare altogether.¹¹ All of the aforementioned risk factors suggest that undocumented immigrants may be vulnerable population to chronic pain.

Information about the prevalence of chronic pain among undocumented immigrants is needed to inform prevention, intervention, advocacy, and policy efforts. To our knowledge, no prior studies have addressed chronic pain among undocumented immigrants. Therefore, this study aimed to (1) assess the prevalence of chronic pain and associated vulnerabilities, including history of trauma, among undocumented Latinx immigrants residing near the US–Mexico border and (2) determine whether there is an association between chronic pain and psychological distress in this immigrant population.

METHODS

Design and Sampling

Given its effectiveness for studying hidden and hard-to-reach populations, this cross-sectional study utilized respondent-driven sampling (RDS) as the sampling and data analytic method.^{12,13} RDS uses a structured referral system in which successive waves of participants are recruited to achieve a diverse sample. In contrast to the snowball method, RDS is a network sampling method that captures the link-tracing design of referrals and adapts it to provide the basis for statistical inference. To produce population estimates, RDS uses weights based on the size of the respondent's social network to determine the probability of selection.¹⁴ Details about the RDS methodology used have been described elsewhere.¹⁵

Participants. We determined undocumented status by asking “At present, are you living in the U.S. without a visa or legal documentation?”.¹³ Recruitment began with 3 previously selected undocumented Latinx immigrants, or seeds, identified during formative research. We selected seeds to represent the diversity of the community, including gender, age, place of residence, and relevant immigration characteristics.¹⁶ We provided each seed with 3 referral coupons to recruit other participants. The next waves of recruits were also provided with 3 referral coupons to recruit additional participants. Sampling continued until we achieved equilibrium, with a maximum chain length of 11 waves. Equilibrium was verified empirically using RDS Analyst software,¹⁷ which showed that the final subjects recruited no longer had identical characteristics as the initial seeds. In all, we recruited 257 undocumented Latinx immigrant adults ages 18 and older, mostly of Mexican origin (98%). We excluded 3

participants due to missing data. The analytical sample thus comprised 254 undocumented Latinx immigrants residing in a medium-sized city near the US–Mexico border. To provide the most conservative estimates, and consistent with an RDS approach, we conducted analyses using the 15% population estimate in the target location as a reference and weighted estimates based on participant's size of their social network, yielding a population inference of $N = 22,000$.

Data Collection. Native Spanish-speaking psychology trainees conducted face-to-face semi-structured clinical interviews lasting 1–3 h. To minimize error and increase efficiency, we collected data using a computer-assisted personal interviewing system.¹⁸ Participants provided verbal consent prior to the interviews, and the study was approved by the San Diego State University/University of California San Diego institutional review board.

Measures

Chronic Pain. We assessed our main outcome measure, chronic pain, by using the World Health Organization Composite International Diagnostic Interview (CIDI) Chronic Conditions Module Version 3.0.¹⁹ Responses to history of chronic pain, defined as frequent pain in 1 or more areas of the body for the past 3 months, were dichotomized as yes/no. Among those with pain, we used open-ended questions to assess the type of pain. We categorized responses as (1) lower body, for pain in the feet, knees, and/or legs; (2) upper body, for pain in the hands, arms, and/or shoulders; (3) back/neck; (4) headaches/migraines; (5) generalized; and (6) other (e.g., stomach). The CIDI is a widely used measure and has excellent psychometric properties.¹⁹

Psychological Distress. We assessed psychological distress by using the Spanish version of the 18-item Brief Symptom Inventory (BSI),²⁰ which we pre-tested and adapted during a pilot study.²¹ The BSI assesses psychological distress using symptom patterns along 3 dimensions, including somatic, anxiety, and depression symptoms. The BSI also renders a global severity index (GSI), which captures overall distress. Each item on the scale was rated on a 5-point level of distress scale ranging from 0 = *not at all* to 4 = *extremely*. Using gender-specific community norms, we converted raw scores to standardized T scores for each subscale and the GSI (T score mean = 50; $SD = 10$).²⁰ A T score greater than or equal to 63 denotes clinically significant psychological distress. The BSI has well-established psychometric properties and has been used previously with Latinx immigrants.²² The Cronbach's alpha for the BSI in this study is 0.95.

Trauma History. Participants completed an adapted version of the Traumatic Events Inventory of the Harvard Trauma Questionnaire (HTQ), designed to assess traumatic experiences among at-risk immigrants.²³ The adapted version consisted of 25 items assessing traumatic events along 7

domains, and 2 additional items assessing history of deportation and domestic violence.²⁴ In analyses using RDS to provide population estimates, trauma history was dichotomized as present vs. absent. For regression analyses, we used a total score denoting the sum of different types of traumatic events ranging from 0 to 25. The Cronbach’s alpha for the HTQ is 0.83.

Sociodemographics. Sociodemographic variables included sex, age, marital status, educational attainment, monthly income, employment, and years in the USA. Age at arrival to the USA was not included because it is a function of both age and length of stay.

All measures were adapted for content and language based on results from formative research and pilot testing.^{21,25}

Statistical Analyses

We conducted an *a priori* power analysis to estimate the needed sample size by using OpenEpi, Version 3.01.²⁶ Inferential statistics accounted for design effects and sample weights to produce weighted population estimates. We calculated weights based on the percentage of undocumented immigrants expected to reside in the study location. To evaluate the prevalence of chronic pain and factors associated with chronic pain, we used descriptive statistics and weighted frequencies. Chi-square statistics were used for bivariate analysis, with $p \leq 0.05$ as the level of significance. In our baseline multivariable logistic regression analysis, we assessed the association of chronic pain with psychological distress after controlling for relevant covariates found to be significantly associated with chronic pain in bivariate analyses, including age, years living in the USA, and history of trauma. In additional multivariable models, to identify specific symptoms of psychological distress that could be associated with chronic pain, we replaced psychological distress with somatization (model 2), depression (model 3), or anxiety (model 4). An assessment of collinearity among variables included in the full model showed that there was a moderate positive association between age and years living in the USA ($r = 0.46, p < 0.001$); however, when testing for collinearity, no evidence was found (variance inflation factor for age = 1.00; variance inflation factor for number of years in USA = 1.01). Also, there was no association between age and history of trauma ($r = 0.06, p = 0.32$); thus, age, years in the USA, and trauma were also included in the full models as covariates. We used the SAS software to conduct bivariate and multivariable analyses.²⁷

RDS Assumptions and Weights. For testing RDS assumptions, generating RDS weights, and analyzing population estimates and 95% confidence intervals, we used RDS Analyst software, including the successive sampling (SS) estimator.¹⁷ Diagnostic testing for RDS assumptions showed that the sample reached equilibrium at the 11th wave of recruitment, showed little homophily bias (the tendency for people to share social ties with others exhibiting similar characteristics [e.g., gender recruitment homophily = 1.03]), and met basic

Table 1 Participants’ Characteristics

Factor	Sample (n = 254)		Population (N = 22,000)		
	n	%	N	%	95% CI
Total					
Sex					
Women	176	69	15,268	69	[63.5, 75.4]
Men	78	31	6732	31	[24.5, 36.5]
Age (years)					
18–25	35	14	3,102	14	[8.9, 19.3]
26–35	63	25	5,610	26	[19.3, 31.8]
36–45	105	41	8,844	40	[31.9, 48.2]
≥ 46	51	20	4,446	20	[14.6, 26.0]
Education					
< High school	165	65	13,926	63	[56.1, 70.6]
≥ High school	89	35	8,074	37	[29.4, 43.9]
Employment					
Not working	125	49	10,648	48	[42.1, 54.7]
Working low-risk job	38	15	3,432	16	[10.3, 20.9]
Working high-risk job*	91	36	7,920	36	[29.8, 42.2]
Monthly income					
< \$ 2000 USD	170	67	14,740	67	[59.3, 74.8]
≥ \$ 2000 USD	84	33	7,220	33	[25.2, 40.7]
Marital status					
Married	173	68	14,960	68	[61.1, 74.8]
Single	81	32	7,040	32	[25.2, 38.9]
Years in USA					
≤ 10 years	59	23	4,796	22	[16.1, 27.4]
11–20 years	126	50	11,176	51	[44.7, 57.0]
> 20 years	69	27	6,050	28	[20.5, 34.3]
Trauma history					
No history of trauma	44	17	3,938	18	[14.1, 21.8]
History of trauma	210	83	18,040	82	[78.3, 85.9]

*High job-risk is defined as working in occupations known for having high fatality occupational injuries as classified by the US Bureau of Labor Statistics⁷

RDS assumptions. In short, the characteristics of the weighted sample approximated the characteristics of the larger networks of undocumented Latinx immigrants in the study location.²⁸

RESULTS

Subjects

Participants’ average age was 38.2 years (SD = 11.2). Most were female, married, had low educational attainment, and lived in poverty (Table 1). Approximately half were employed, with most of those (71%) working in jobs with high occupational injury rates.⁷ On average, participants had lived in the USA for 16.4 years (SD = 7.9). Most reported a history of trauma (83%): on average, participants had experienced approximately 5 different types of traumatic events in their lifetime (mean = 4.5; SD = 4.1; range 0–19).

Prevalence of Chronic Pain and Associated Vulnerabilities

A total of 28% of participants reported having chronic pain, with 46% of these having arthritis. Among participants with chronic pain, pain was primarily described as generalized pain (29%), back pain (24%), pain in the lower body (19%), pain in the upper body (13%), and headaches/migraines (13%). Also, 2% of participants described their pain as other.

Table 2 Prevalence of Chronic Pain and Psychological Distress by Sociodemographics, Immigration Characteristics, and Trauma History

Factor	Chronic pain			Psychological distress among those with chronic pain	
	N = 22,000	Yes (%)	p	Yes (%)	p
Total	6072	28		20	0.005
Sex					
Women	5786	28	0.647	17	0.373
Men	6116	30		26	
Age (years)					
18–25	3762	17	< 0.001	67	0.017
26–35	2090	10		33	
36–45	7326	33		14	
≥ 46	9922	45		13	
Education					
< High school	6402	29	0.457	17	0.303
≥ High school	5434	25		27	
Employment					
Not working	6160	28	0.377	20	0.496
Working low-risk job	7480	34		12	
Working high-risk job*	5016	23		28	
Monthly income					
< \$ 2000 USD	6204	28	0.731	23	0.368
≥ \$ 2000 USD	5764	27		14	
Marital status					0.031
Married	5984	27	0.838	13	
Single	6248	28		35	
Years in USA					
≤ 10 years	3366	15	< 0.001	11	0.193
11–20 years	5192	24		30	
> 20 years	10,032	46		13	
Trauma history					
No history of trauma	506	2	< 0.001	0	0.615
History of trauma	7260	33		20	

*High job-risk is defined as working in occupations known for having high fatality occupational injuries as classified by the US Bureau of Labor Statistics⁷

Bivariate analyses showed significant differences in the prevalence of chronic pain across age groups (Table 2), with older undocumented immigrants reporting a greater prevalence of chronic pain when compared with younger participants. Specifically, the prevalence of chronic pain among younger immigrants (ages 18–35) ranged between 10 and 17%, whereas it ranged between 33 and 45% for older immigrants (ages 36 and older; $p < 0.001$). Also, significant differences were found by years living in the USA, with participants who had lived longer in the USA reporting greater prevalence of chronic pain. For instance, the prevalence of chronic pain among immigrants who have lived in the USA for less than 10 years was 15% versus 46% among those who have lived in the USA for longer than 20 years ($p < 0.001$). Significant differences in chronic pain were also found by trauma history, with participants reporting a history of trauma having a greater prevalence of chronic pain: 33% among immigrants with trauma history versus 2% for those without trauma ($p < 0.001$).

Association of Chronic Pain and Psychological Distress

A total of 20% of undocumented immigrants with chronic pain met the criteria for clinically significant psychological distress (Table 2). Bivariate analyses showed significant differences in psychological distress among participants with versus without chronic pain with subjects having chronic pain being 3 times more likely to report clinically significant psychological distress than those without pain (OR = 3.04, 95% CI [1.36, 6.76]; $p = 0.005$). Also, among immigrants with chronic pain, bivariate analyses showed significant differences in psychological distress across age groups, with younger immigrants reporting greater distress when compared with their older counterparts. For instance, among 18–25-year-old immigrants, 67% reported distress, compared with 33% for ages 26–35, 14% for ages 36–45 and 16% for ages ≥ 46 ($p = 0.017$). Likewise, 35% of single immigrants with chronic pain reported distress vs. 13% of married immigrants ($p = 0.031$).

In multivariable analysis, chronic pain was significantly associated with psychological distress (OR = 1.06, 95% CI [1.02, 1.09], $p = 0.001$), with those reporting higher psychological distress more likely to also report chronic pain. Also, history of trauma and age were significantly associated with chronic pain. Specifically, undocumented immigrants with a history of more trauma episodes were more likely to report chronic pain (OR = 1.10 per additional traumatic event, 95% CI [1.02, 1.19], $p = 0.014$). Also, older immigrants were more likely to report chronic pain (OR = 1.05 per each year increase in age, 95% CI [1.02, 1.09], $p = 0.002$).

Post hoc analyses to identify specific symptoms of psychological distress associated with chronic pain showed that after controlling for age and years in the USA, chronic pain was significantly associated with somatization (OR = 1.09, 95% CI [1.05, 1.13], $p < 0.001$; Table 3), with those reporting more somatic symptoms being more likely to report chronic pain. Likewise, anxiety was significantly associated with chronic pain (OR = 1.04, 95% CI [1.01, 1.08], $p = 0.017$), with those reporting more anxiety symptoms being more likely to report chronic pain. With regards to depression, there was a borderline significant association between the number of depression symptoms and prevalence of chronic pain (OR = 1.03, 95% CI [1.00, 1.06], $p = 0.049$). In the 3 aforementioned models, history of trauma and age were also significantly associated with chronic pain: undocumented immigrants with more trauma episodes and those who were older were more likely to report chronic pain (Table 3).

DISCUSSION

Although chronic pain and psychological distress are common worldwide, no previous study has reported their prevalence and characteristics among undocumented Latinx immigrants in the USA, a vulnerable population. As such, our first goal was to assess the prevalence of chronic pain among undocumented Latinx immigrants. Slightly over a quarter of

Table 3 Adjusted Analyses for Factors Associated with Chronic Pain

Variable	Chronic pain		
	OR	95% CI	<i>p</i>
Base case model: psychological distress			
Age	1.05	[1.02; 1.09]	0.002
Years in USA	1.04	[0.99; 1.08]	0.095
Trauma history	1.10	[1.02; 1.19]	0.014
Psychological distress (BSI GSI T)	1.06	[1.02; 1.09]	0.001
Nagelkerke $R^2 = 0.28$	$\chi^2 (4, N = 254)$		
C-statistic = 0.79	= 53.90		
Model 2: somatization			
Age			
Years in USA	1.05	[1.02; 1.09]	0.002
Trauma history	1.04	[0.99; 1.08]	0.121
Somatization (BSI T)	1.10	[1.01; 1.18]	0.021
Nagelkerke $R^2 = 0.33$	1.09	[1.05; 1.13]	< 0.001
C-statistic = 0.81	$\chi^2 (4, N = 254)$		
		= 65.14	
Model 3: depression			
Age			
Years in USA	1.05	[1.02; 1.08]	0.002
Trauma history	1.04	[1.00; 1.09]	0.058
Depression (BSI T)	1.14	[1.05; 1.23]	0.001
Nagelkerke $R^2 = 0.24$	1.03	[1.00; 1.06]	0.049
C-statistic = 0.78	$\chi^2 (4, N = 254)$		
		= 46.32	
Model 4: anxiety			
Age			
Years in U.S.	1.05	[1.02; 1.09]	0.002
Trauma history	1.04	[1.00; 1.08]	0.067
Anxiety (BSI T)	1.13	[1.05; 1.22]	0.002
Nagelkerke $R^2 = 0.25$	1.04	[1.01; 1.08]	0.017
C-statistic = 0.78	$\chi^2 (4, N = 254)$		
		= 48.16	

immigrants reported having chronic pain, similar to the rate reported for the US Latinx population at large (28%)^{29,30}. Additionally, our findings showed that back pain was the most common type of chronic pain in this population, with a prevalence of 24%. Although the aforementioned estimates for undocumented Latinx immigrants are comparable with those of the US Latinx population, it is important to emphasize that the experience of chronic pain among undocumented immigrants may be particularly distressing. In addition to having limited access to healthcare, which is essential to manage chronic pain, undocumented immigrants depend on their jobs to make ends meet and must maintain good health to endure demanding work conditions. As such, chronic pain in this population could result in severe occupational consequences, such as job loss.⁵ Our findings highlight the need to address

chronic pain as a public health concern in this at-risk immigrant population, given its negative health, social, and economic effects.

Another aim of this study was to assess the association between chronic pain and psychological distress. Results showed that psychological distress is common and significantly associated with chronic pain. We found that psychological distress as a whole and specific psychological distress symptoms were associated with chronic pain. Specifically, in multivariable analyses, somatic and anxiety symptoms were significantly associated with chronic pain, while depression had a borderline significant association with chronic pain.³¹ These findings are consistent with previous research conducted among populations worldwide, which support the co-occurrence of chronic pain with mood and anxiety disorders.^{32,33} Beyond co-occurrence, research has demonstrated a bidirectional relationship between mental health, specifically depression and anxiety, and chronic pain where each influences the other to a similar magnitude.³⁴ Of note, the relationship of depression and chronic pain has been particularly emphasized in previous research, with less attention given to understanding the effect of anxiety and somatic symptoms on chronic pain, and vice versa. Anxiety and somatic symptoms are likely to increase catastrophic thinking, hypervigilance of pain symptoms, and fear avoidance of pain sensations, all of which could significantly impair functional ability and interfere with treatment regimens.³⁵ Noteworthy is that findings from bivariate analyses showed that despite having the second lowest rate of chronic pain, the youngest undocumented immigrants (ages 18–25) reported the highest levels of psychological distress. Living with chronic pain is challenging, and even more so for young people facing complex biological, psychological, and social challenges,³⁶ such as those often experienced by young undocumented immigrants.³⁷ The negative impact that chronic pain may have on the functional ability of younger immigrants to manage their busy life schedules, face demanding living conditions, and strive to achieve the American Dream may also contribute to the increased rates of distress reported by these young immigrants with chronic pain. Future studies should further explore the association of chronic pain, anxiety, and somatic symptoms among this immigrant population, particularly young immigrants.

Moreover, our study also identified vulnerabilities associated with chronic pain among undocumented immigrants. Similar to age-related effects found in previous studies of chronic pain in the general population, our study highlights older age as a risk factor.^{29,30} Musculoskeletal pain (e.g., due to osteoarthritis) is common among older individuals and could potentially explain the association between older age and chronic pain³⁸; our sample was relatively young (mean [SD], 38.2 [11.2] years) and yet about one-quarter of the sample reported chronic pain. Undocumented immigrants often undertake physically demanding jobs and heavy labor, which in turn it may lead to more musculoskeletal pain and possible arthritic changes at an earlier age. Indeed, over time, the continued exposure to

hardship, heavy labor, and stressful environments that undocumented immigrants face may increase their risk for chronic pain.³⁹ Future studies are needed to identify how contextual stressors, such as work environments, faced by undocumented immigrants may contribute to chronic pain over time, particularly as immigrants become older and unable to work.

Another interesting finding in our study was that history of trauma is associated with chronic pain in a dose-response fashion: the more traumatic episodes the person has experienced, the greater the chance that he or she is experiencing chronic pain. This finding is consistent with previous research supporting the association between lifetime frequency of trauma and chronic pain.⁹ Research suggests that being exposed to traumatic events can prolong activation of one's stress response system, which in turn suppresses the immune system; breaks down neural tissue, bone, and muscle; and impairs tissue growth and repair, thus increasing susceptibility to chronic pain.⁴⁰ Additional research is needed to identify and understand the mechanisms through which trauma may be associated with chronic pain, particularly in populations that experience stress and trauma as is the case of many undocumented immigrants.

Limitations

Our study had several limitations. Although RDS is the most effective epidemiological method to study hidden populations,⁴¹ it has some methodological limitations.⁴² Nonetheless, steps were taken to collect data from a representative sample. Although the sample size may appear to be small, we studied a hidden or hard-to-reach population about which little is known, and our sample is within the recommended size for RDS studies to facilitate calculating population-based estimates. Thus, our results reflect prevalence estimates for approximately 22,000 undocumented Latinx immigrants in the target region. Second, this study assessed prevalence of chronic pain, but not severity of pain or functional impairment due to pain. Additional studies are needed that can further elucidate how severity of pain and impairment affect the quality of life of undocumented immigrants living with chronic pain. Next, psychological distress in this border community may be different from that experienced by undocumented immigrants in other US regions. Follow-up studies with different populations of undocumented immigrants are needed. Our sample was predominantly female and on average participants had lived in the USA for more than 10 years. Thus, these data are more representative of established undocumented Latinx US immigrants as opposed to recent immigrants. Assessments were based on retrospective reporting, which may lead to biases and may result in inaccurate estimates.⁴³ Finally, this study was cross-sectional; thus, causation cannot be inferred.

CONCLUSION

Our findings emphasize the magnitude of chronic pain as a health concern for undocumented immigrants, with attendant

public health implications. Better prevention and treatment efforts are warranted—in particular, context- and culture-sensitive interventions. Revising policies to devise solutions grounded in evidence and developing new alternatives to facilitate access and provision of health services to undocumented immigrants are critical to prevent suffering and the detrimental health, economic, and social consequences associated with chronic pain.

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Compliance with Ethical Standards:

Conflict of Interest: The authors declare that they do not have a conflict of interest.

Ethical Statement: Participants provided verbal consent prior to the interviews, and the study was approved by the San Diego State University/University of California San Diego institutional review board.

REFERENCES

1. **Goldberg DS, McGee J.** Pain as a global public health priority. *BMC Public Health* 2011; 11:770.
2. **Smith BH, Elliot, AM, Chambers, WA, et al.** The impact of chronic pain in the community. *Family Practice* 2001; 18:292-299.
3. Institute of Medicine. Report from the Committee on Advancing Pain Research, Care, and Education: Relieving Pain in America. A Blueprint for Transforming Prevention, Care, Education and Research. *The National Academies Press* 2011. http://books.nap.edu/openbook.php?record_id=13172&page=1.
4. **Hollingshead NA, Ashburn-Nardo L, Stewart JC, et al.** The pain experience of Hispanic Americans: A critical literature review and conceptual model. *J Pain* 2016; 17(5): 513-528.
5. **Orrenius PM, Zavodny M.** Do immigrants work in riskier jobs? *Demography* 2009;46(3): 535-551.

6. **Krogstad JM, Passel JS, Cohn D.** 5 facts about illegal immigration in the U.S. *Pew Research Center* 2017. <http://www.pewresearch.org/fact-tank/2017/04/27/5-facts-about-illegal-immigration-in-the-u-s/> (accessed 2, July 2017)
7. U.S. Bureau of Labor Statistics. Foreign-born workers: labor force characteristics – 2015. News Release. https://www.bls.gov/news-release/archives/forbrn_05192016.htm.
8. **Siqveland J, Hussain A, Lindstrom JC, et al.** Prevalence of Posttraumatic Stress Disorder in persons with chronic pain: A meta-analysis. *Front Psychiatry* 2017;14: 164.
9. **Turk DC, Okifuji A.** Psychological factors in chronic pain: Evolution and revolution. *J Cons Clin Psych* 2002;70(3), 678-690.
10. **Garcini LM., Peña JM, Gutierrez AP, et al.** "One scar, too many:" The association of traumatic events and psychological distress among undocumented Mexican Immigrants. *J Trauma Stress*, 2017; 30(5): 453-462.
11. **Wallace SP, Torres J, Sadegh-Nobari T, et al.** Undocumented and uninsured: Barriers to affordable care for immigrant population. *UCLA Center for Health Policy Research*. <http://www.escholarship.org/uc/item/8ds5h7k3> (accessed 10, November, 2018).
12. **Montealegre JR, Risser JM, Selwyn BJ, et al.** HIV testing behaviors among undocumented Central American immigrant women in Houston, Texas. *J Immigr Min Health* 2012;14(1): 116-123.
13. **Zhang SX.** *Trafficking of migrant laborers in San Diego County: Looking for a hidden population*. San Diego, CA: San Diego State University. 2012
14. **Tyldum G, Johnston LG.** *Applying Respondent Driven Sampling to Migrant Populations: Lessons from the Field*. Palgrave MacMillan. 2014.
15. **Garcini LM, Peña JM, Galvan T, et al.** Mental disorders among undocumented Mexican immigrants in high-risk neighborhoods: Prevalence, comorbidity, and vulnerabilities. *J Cons Clin Psych* 2017; 85(10), 927.
16. **Heckathorn DD.** Respondent-driven sampling II: deriving valid population estimates from chain-referral samples of hidden populations. *Soc Prob* 2002;49(1): 11-34.
17. **Handcock MS, Fellows IE, Gile KJ.** RDS Analyst: Software for the analysis of Respondent-Driven Sampling data. Version 0.42. 2014.
18. Questionnaire Development System V. 3.0 Nova Research Company. <http://www.novaresearch.com/Products/index.cfm>. 2014.
19. Composite International Diagnostic Interview (CIDI) : Core Version 1.1. [Geneva] :World Health Organization, 1993.
20. **Derogatis LR.** *BSI Brief Symptom Inventory: Administration, Scoring, and Procedure Manual* (4th Ed.). Minneapolis, MN: National Computer Systems. 1993.
21. **Peña JM, Garcini LM, Gutierrez AP, et al.** Traumatic Events and Symptoms among Mexican Deportees in a Border Community. *J Immigr Refugee Studies* 2016;15(1): 36-52.
22. **Torres L, Miller MJ, Moore KM.** Factorial invariance of the Brief Symptom Inventory-18 (BSI-18) for adults of Mexican descent across nativity status, language format, and gender. *Psychol Assess* 2013;25(1): 300-305.
23. **Mollica RF, Caspi-Yavin Y, Bollini P, et al.** The Harvard Trauma Questionnaire: Validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. *J Nervous Mental Dis* 1992;180(2), 111-116.
24. **Garcini, L.M., Peña, J.M., Gutierrez, A.P., Fagundes, C., Lemus, H., Lyndsay, S., & Klonoff, E.A.** (2017). "One scar, too many:" The association of traumatic events and psychological distress among undocumented Mexican Immigrants. *Journal of Traumatic Stress*, 30(5), 453-462.[doi:https://doi.org/10.1002/jts.22216](https://doi.org/10.1002/jts.22216).
25. **Beaton DE, Bombardier C, Guillemin F, et al.** *Recommendations for the Cross-Cultural Adaptation of Health Status Measures*. Rosemont, IL: American Academy of Orthopedic Surgeons 2002. http://med.umn.edu/ortho/prod/groups/med/@pub/@med/@ortho/documents/asset/med_asset_360072.pdf (accessed 10, October 2013)
26. **Dean AG, Sullivan KM, Soe MM.** OpenEpi: Open Source Epidemiologic Statistics for Public Health, Version. 3.01. 2013. www.OpenEpi.com. (accessed 15, November, 2013).
27. SAS [computer program]. Version 9.4. Cary, NC: SAS Institute Inc; 2014.
28. San Diego Association of Government (2016). *Demographics in the San Diego region*. San Diego, CA. January. Retrieved November 19, 2016 from http://www.sandag.org/uploads/publicationid/publicationid_2001_20213.pdf
29. **Johannes CB, Le TK, Zhou X, et al.** The prevalence of chronic pain in United States adults: results of an Internet-based survey. *J Pain* 2010;11(11): 1230-1239.
30. **Hardt J, Jacobsen C, Goldberg J, et al.** Prevalence of chronic pain in a representative sample in the United States. *Pain Med* 2008;9(7): 803-812.
31. **Abelson RP.** *Statistics as principled argument*. Hillsdale, N.J: L. Erlbaum Associates. 1995.
32. **Asmundson GJ, Katz J.** Understanding the co-occurrence of anxiety disorders and chronic pain: state-of-the-art. *Depress Anxiety* 2009;26(10): 888-901.
33. **McWilliams LA, Cox BJ, Enns MW.** Mood and anxiety disorders associated with chronic pain: an examination in a nationally representative sample. *Pain* 2003;106(1-2): 127-133.
34. **Bondesson E, Larrosa Pardo F, Stigmar K, et al.** Comorbidity between pain and mental illness- Evidence of a bidirectional relationship. *Eur J Pain* 2018;(22)7:1304-1311.
35. **Woo AKM.** Depression and anxiety in pain. *Rev Pain* 2010;4(1):8-12.
36. **Slater H, Jordan J, Chua J, et al.** Young people's experiences of persistent musculoskeletal pain, needs, gaps, and perceptions about the role of digital technologies to support their co-care: A qualitative study. *BMJ Open* 2016; 6(12): e014007.
37. **Garcini LM, Peña JM, Galvan T, et al.** DREAMers and their double standard of living in the United States: A contextual perspective and clinical implications. *Am J Psych* 2017; (174)7:623-625. doi: <https://doi.org/10.1176/appi.ajp.2017/17040395>
38. **Brown ST, Kirkpatrick M, Swanson MS, et al.** Pain experience of the elderly. *Pain Man Nurs* 2011;(2)4:190-196.
39. **Wright AR, Gatchel RJ.** Occupational Musculoskeletal pain and disability. In D. C. Turk & R. J. Gatchel (Eds.), *Psychological approaches to pain management: A practitioner's handbook* 2002:349-364. Guilford Press.
40. **Gatchel RJ, Peng YB, Peters ML, et al.** The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull* 2007;133(4): 581-624.
41. **Heckathorn DD.** Respondent Driven Sampling: A new approach to the study of hidden populations. *Soc Prob* 1997;44(2): 174-199.
42. **Goel S, Salganik MJ.** Assessing respondent-driven sampling. *Proc Natl Acad Sci U S A* 2017;107(15):6743-6747.
43. **Brewin CR, Andrews B, Gotlib IH.** Psychopathology and early experience: A reappraisal of \ retrospective reports. *Psychol Bull* 1993;113: 82-98.

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